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AUTHOR	Galani, Areti; Chalmers, Matthew
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ABSTRACT

This paper explores issues of social context and interaction between digital and physical museum visitors, using as a focus of discussion the "City" project, itself set within a larger interdisciplinary project called "Equator." The paper looks at collaborative environments that span different media, in particular handheld mobile devices, Web-based hypermedia, and 3D virtual environments. Two main research strands are discussed: the methods and results of two pilot visitor studies in two cultural institutions in Glasgow (Scotland)--the Lighthouse and the House for an Art Lover--and the development of a prototype system that establishes three-sided collaboration between physical, Web, and virtual environment visitors. Preliminary results and issues arising from the on-going system development and user trials are then presented. Future plans for further system evaluation and deployment are addressed. (Contains 15 references.) (Author/MES)

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Can You See Me? Exploring Co-Visiting Between Physical And Virtual Visitors

Areti Galani and Matthew Chalmers, University of Glasgow, Department of Computing Science, UK

http://www.dcs.gla.ac.uk/equator/city.html

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Abstract

We explore issues of social context and interaction between digital and physical museum visitors, using as a focus of discussion the *City* project, itself set within a larger interdisciplinary project called Equator. We look at collaborative environments that span different media, in particular handheld mobile devices, Web-based hypermedia and 3D virtual environments. We discuss two main strands in our research: the methods and results of two pilot visitor studies in two cultural institutions in Glasgow—the Lighthouse and the House for an Art Lover—and the development of our prototype system which establishes three-sided collaboration between physical, Web and virtual environment visitors. We then present preliminary results and issues arising from our on-going system development and user trials. We conclude with future plans for further system evaluation and deployment.

Keywords: Visitor studies, social context, virtual reality, wearable computers, hypermedia.

Introduction

In their definition of the interactive museum experience, Falk and Dierking (1992) described three key elements that influence the way visitors experience museums: the physical context, the personal context and the social context. Physical context mainly covers the physical layout of the space and has been extensively studied by designers (Communications Design Team, 1976) and more recently by space syntax theoreticians (Psarra, Grajewski & O'Neil, 2002). Personal context covers the prior knowledge of the visitors, their personal aims and expectations, and their current state of mind. Personal context and its influence on the learning experience have also been studied by means of evaluation teams and learning theories such as constructivism and Gardner's multiple intelligences theory. Last, but not least, social context covers the social interaction during the museum visit between the visitors and their immediate companions, as well as other visitors and museum staff. Several aspects of the social context in a physical museum setting have been examined, focusing mainly on school groups and families (Diamond, 1986; McManus, 1987; Falk & Dierking, 1992). More recently, social scientists in the *SHAPE* project also examined the social cues in the interaction with displays (Vom Lehn, Heath & Hindmarsh, 2001).

This paper further examines social context in museums, and its technological support. We are especially interested in social context

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among new audiences who visit museums via the Web and 3D virtual reality applications. While studies of traditional museum audiences have shown the importance of social context, new media as used in museums do not often support social interaction. In studying both traditional museums and new technologies, we aim to address issues such as how to integrate visits to the virtual museum with visits to the 'physical' museum, especially when a visitor may visit both. This is partly a response to the way that the number of digital visitors is steadily growing and, in some cases, outstripping the number of visitors to the corresponding physical museums (Lord, 1999). As a result, many wish to find ways to encourage the geographically distant digital visitor to become a physical visitor, and to encourage physical visitors to maintain a relationship with the museum after they walk out its door.

Our project, *City*, investigates ways to support and enrich context in museums, cultural institutions and the city—in particular, social context. Set within a research consortium called Equator (www.equator.ac.uk), our work is on context that involves something richer and more complex than a collection of isolated media and disjointed pieces of information. Computer scientists as well as museum professionals—for different reasons—tend to focus on the obvious differences between traditional and digital media, and treat each one independently. Here, a broader viewpoint takes account of their similarities and interdependencies.

We initially discuss our approach to understanding and working with social context, pointing out prior work in both traditional and digital media. We then present two parallel lines of work that share a theme: the architect, designer and artist, Charles Rennie Mackintosh (1868-1928). We report on studies of social interaction in existing museums and exhibitions, and on a system infrastructure and prototype to bridge digital and physical visits to an exhibition room and its collection of artifacts. This prototype supports interaction between people visiting or exploring the room, even though they use quite different media: wearable computers, hypermedia and virtual environments. Thus a visitor using any one of these styles can interact with other visitors using other media. We offer some initial observations on the use of our prototype system before outlining our ongoing and planned work.

Social context

We approach the issue of social context by considering interaction between visitors. We initially use a deliberately naïve categorization of context, dividing it in terms of time, space and medium. First, interaction may be synchronous or asynchronous. Secondly, it may occur locally, within the museum, or remotely, with at least one visitor being physically located beyond its walls. Thirdly, it may involve digital media such as Web sites and virtual environments, or traditional 'physical' media such as the museum building itself, displays and, of course, the artefacts of the museum collection.

One experiences synchronous social awareness when visiting a museum with some friends or as a member of a larger group: one's *co–visitors*. The design of the exhibition space, through its layout, displays, artefacts and supporting materials, clearly influences the visitor's movement and activity, but the way co–visitors move around the space is also influential. Other visitors who happen to be in the museum at the same time may also have an effect, as may those who visited at some time in the past.

This latter influence, asynchronous social awareness, is a key feature of the museum experience. Traditionally afforded comment books, visitors can write about what they did or felt during their museum experience. Any later visitor can read the comments; i.e. the communication is not generally personalized or directed towards any one particular reader. Recently entire exhibitions and displays have revolved around this notion of social context. For example, in London, visitors to the Science Museum (www.sciencemuseum.org.uk) can read other visitors' opinions on controversial issues, and in the interactive games of the Wellcome Wing can compare their results with those of previous visitors. Visitors also have the opportunity to create a Web page with the highlights of their visit, and access it later online with their friends and family. This raises the issue of whether and how to structure, curate or select from such contributed 'collections' as they grow in size and value.

Web sites may offer various forms of social awareness. These may be synchronous, as in chat rooms, or asynchronous, as in mailing lists and recommendations. Awareness much like that of comment books is afforded by, for example, the Amazon.com bookstore. One can leave comments about specific books, CDs and so forth, and can read comments from earlier visitors. However, dynamic and personalized information can be cheaply offered when compared to traditional media. For example, each Amazon visitor's profile of movement around and purchases from the site is dynamically combined with others in creating recommendations for the individual, i.e. selections from the many items sold by Amazon, based on the match between a visitor's profile and those of earlier visitors. Each movement and purchase leads to different personalized recommendations. The *Hippie* (Oppermann & Specht, 1999) and the *SottoVoce* projects (Aoki & Woodruff, 2000) have already explored many of the issues involved in the personalized delivery of content in a museum environment but, as far as we know, recommender systems have not yet been applied in museums.

Synchronous social interaction is also a key feature in virtual environments. The vast computer game industry is centred on such technology, and is now exploring the possibilities of collaborative game playing on-line. Furthermore, chat channels such as Active Worlds (www.activeworlds.com) combine directed textual communication with graphical representation of users as avatars. Museums and related institutions have explored the same medium, but for purposes such as the presentation of artefacts too fragile or numerous to be put on display and of reconstructed archaeological sites, and in supporting geographically distant visitors. Such a medium supports social interaction between visitors, as in the Virtual Leonardo project in the National Museum of Science and Technology in Milan (www.museoscienza.org), and the Van Gogh Museum in Amsterdam (www.vangoghmuseum.nl). Web users share a common representation of the museum and are afforded basic resources for social interaction: mutual visibility and audibility. Immersive VR technology, such as head-mounted displays and room-sized (and room-shaped) projection surfaces, is used in a number of cultural institutions, e.g. the Foundation of the Hellenic World (www.fhw.gr). Relatively little support is given in such systems for asynchronous awareness, however.

Most research on museums and the Web has, we suggest, tended to treat local and remote visitors in isolation from each other, and to treat traditional and digital media similarly. To our knowledge, there has been little or no work that bridges between local and remote, and between traditional and digital media. However, those who visit the digital

museum may visit the traditional museum, and vice versa. Previously seen digital information may influence a visitor's interpretation of traditional displays and artefacts, and vice versa. New technologies let visitors to the traditional museum interact with digital visitors, and combine traditional and digital media, in the same experience.

In order to deepen our understanding of social context, we have undertaken a pair of ongoing studies of social awareness and context in traditional museums and cultural institutions. These are described in the next section. We then describe a parallel stream of activity within our project, building a technological infrastructure for co–visiting and synchronous social context that crosses or blurs the boundaries between visitors who are local and remote, and between digital and traditional media. As described in a later section, ongoing and future work is directed towards applying the results of our studies to our systems, especially with regard to more explicit support for the roles visitors take with regard to each other, and towards asynchronous interaction.

Studies

In collaboration with two institutions in Glasgow, The Lighthouse (www.thelighthouse.co.uk) and the House for an Art Lover (www.houseforanartlover.co.uk), we are carrying out two sets of visitor studies of qualitative character. Our methodology is influenced by recent qualitative museum visitor studies as well as by ethnographic and anthropological methods used in social sciences and recently in computing science. Our aim is to better understand the relationship between the visitor and the social context and environment of the visit. These studies, unlike the majority of the visitor studies conducted in the museum sector, do not look at interactions around specific displays or temporary exhibitions. Instead, both studies are situated in permanent exhibitions.

We believe that qualitative methods, such as naturalistic ethnography, in the exploration of visitors' interaction are necessary to achieve a better understanding of 'how visitors see things, and what meanings they give to their experiences, rather than simply to enumerate frequencies for pre-formed categories' (MacDonald, 1993). Furthermore, our corpus of observations can be used to address either of two related issues: the generation and delivery of content, and social interaction during the visit. The latter will be the main focus of the following discussion.

The two institutions were chosen because they share the same topic, Mackintosh, but they explore different ways of engaging the visitor. The Lighthouse has developed an interpretation centre, often simply called the Mack Room, with a number of original objects intermixed with 23 workstations and displays that convey a substantial amount of digital information. The House for an Art Lover is a recently constructed house, but built, decorated and furnished according to Mackintosh's entry to a 1901 design exhibition. It is widely perceived as a historic house attraction, and a visitor is offered a leaflet and an audioguide that describe the construction project and Mackintosh's work.

In the Lighthouse we watched visitors and in eight cases manually recorded their movements on a map. In the House for an Art Lover we conducted participant observation of visitors for six days within a period of two months. In both locations, we used photographs and notes to add to our record of visitor activity. We also obtained some other sources of

information regarding visitor experience. We were offered copies of the Mack Room designer's architectural drawings, showing the expected flow of archetypal visitors around the exhibits in the Mack Room, along with notes on the expected experiences gained by following such paths. In the House for an Art Lover, we were given access to the results of a marketing survey of visitors.

In our studies we concentrated on 'casual visitors' (Falk & Dierking, 1992) in groups or as singletons, rather than the more structured visits of school groups and families. We focused on interpersonal interaction, and also observed how the information delivery media available in the gallery, such as audioguides, touch-screens, videos, labels and so forth, influenced this interaction.

We categorized the interaction between co-visitors into three main styles. In the first, co–visitors are tightly connected, staying together during their visit, and interacting with the same display at the same time. In the second style, co-visitors are loosely connected: they interact with different displays, but in the same area and thus stay relatively close to each other. Thirdly, co–visitors are independent navigators, following their own individual routes for the main part of the visit and meeting with each other only occasionally.

In tightly connected interaction, co–visitors stay close to each other as they actively and collaboratively interact with the displays, discussing artefacts and their descriptions. An important influence on this style of interaction is the background knowledge of visitors and their history of previous visits to the gallery. The most experienced usually leads the interaction by operating the touch screens (Fig.1), or by pointing out details not obvious from the labels/commentaries (Fig. 2). Different co–visitors may undertake the leading role at different times during a visit.

Figure 1. An interactive display in the Mack Room is operated by a visitor with more background knowledge of the exhibition than his co–visitor.

Figure 2. The visitor on the right, who has been in the House for an Art Lover several times before, points out and describes to her co–visitor a less obvious feature of the ceiling lights' design

The pace of the visit is an essential factor in this style. People usually share their interests in the displays and also share a pace of reading the available material. They also decide together where to go next. This style

of interaction occurs quite often in galleries where information is not easily available or accessed, so people tend to move around together and help each other to interpret the exhibits.

In the second style of interaction, co–visitors are loosely connected. These visitors do not consistently interact with the same objects and displays, but stay close enough to maintain an awareness of each other. They usually exchange brief comments about what they have seen and point things out to each other. They may be very close to each other but engaged in quite different information, as in the leaflet reader and audioguide listener in Figure 3, and may attend to different displays at any given moment, as in Figure 4.

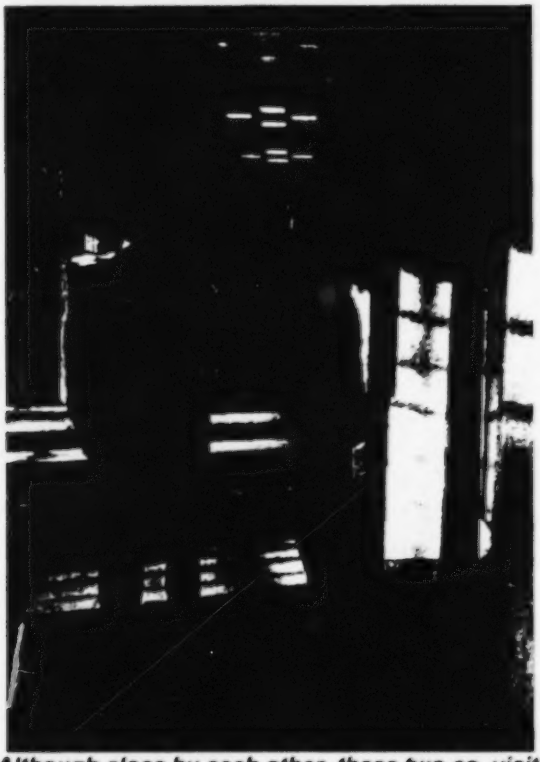

Figure 3. Although close by each other, these two co–visitors in the House for an Art Lover are attending to different sources of information: an audioguide and a leaflet respectively

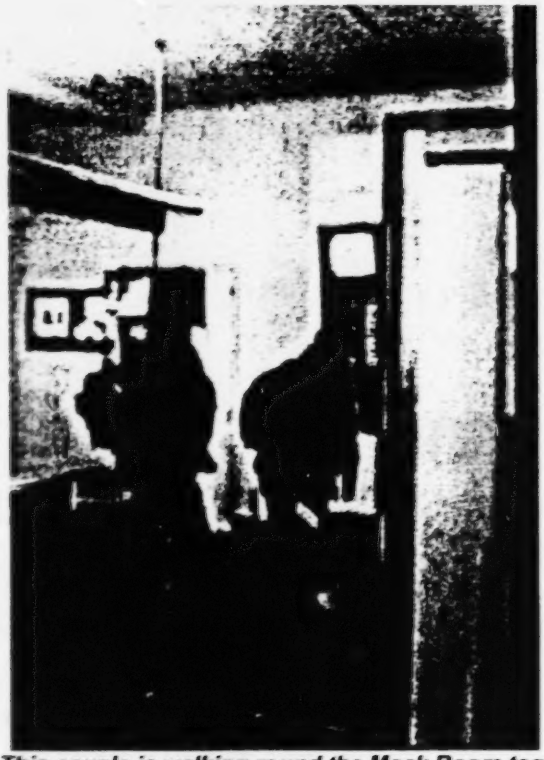

Figure 4. This couple is walking round the Mack Room together, but the woman on the right interacts with a touch screen while her companion, on the left, looks over her shoulder at a video display.

Visitors using audioguides usually experience this style of interaction. The audioguide often works as a resource for discussion despite the fact the device itself is not designed to support explicit interaction between visitors. This style of co-visiting also seems to favour gestural communication: a person may want to share an experience but not to interrupt the companion's experience, so favours hand gestures or eyebrow movements rather than verbal communication.

Independent navigation occurs in co–visitors who visit displays separately from each other. Each person has an individual pace, resulting sometimes in people waiting for the co–visitors outside the galleries, or 'slow' visitors cutting their visits short in order to catch up with others. Repeat visitors to the gallery often follow this style, and in some cases they leave the immediate space of the gallery and proceed to another room. Repeat visitors also tend to not take the audioguide at all or to consult it very infrequently compared to less experienced co–visitors.

This style of co-visiting includes many meeting points between the members of the group: sometimes accidental, sometimes deliberate. For example, two co–visitors may meet accidentally when their independent paths cross in a display that is of interest to both. In order to deliberately meet, one visitor may change navigation in the space, moving very quickly between points with good visibility in the gallery in order to find the co–visitor. Regardless of the way people meet, they discuss what they have seen in their individual tours, or suggest displays to each

other—in some cases almost dragging their companions to show them a specific display. They also discuss the logistics of the visit; for example, where to go next, when they will have lunch, and so forth.

It is important to point out visitors do not rigidly conform to the same archetypal style of interaction during a visit. In all observed cases, co–visitors experienced their immediate social context through direct and close interaction at some times, and peripheral awareness at other times. Each co-visitor takes advantage of a dynamically changing set of resources. We identified mutual audibility, mutual visibility and shared content as essential resources in co-visiting. These three do not influence each of the interaction styles described above to the same extent.

Closely connected co–visitors use all three of the resources extensively. They have concrete knowledge of their companions' locations and orientations, which are often similar to their own. They talk almost constantly with each other, and share content whether in the form of touch screens, video screens or labels. They can share and explore interpretations of content seen or heard previously. Loosely connected co–visitors are also aware of each other's location and possibly orientation at any given moment. They use verbal or gestural communication, but they do not necessarily share content synchronously. Finally, independent navigators are only peripherally aware of their companions' locations. Such a visitor will usually inform co–visitors in a room when about to leave it, and indicate a destination, if their mutual awareness extends beyond a single room. They do not constantly share other resources but are potential users of all of them during meetings.

The Current System

In parallel with our studies, we have developed a system to explore social context that bridges or blurs the boundaries between visitors who are local and remote, and between digital and physical. The system involves three types of visitors: someone walking around the Mackintosh Room with a wearable computer, someone remote from the Mack Room but moving through Web pages related to the room, and another remote visitor using a VR model of the Mack Room.

A set of scenarios (Chalmers, 2001; Galani, 2001) was used to further explore the concept of co-visiting in museums and the city, and as a focus for system design. In our current scenario a visitor to Glasgow, Vee, visits the Mack Room in The Lighthouse. While browsing the displays, she invites her friend Anna, who is some distance away, to join her on the visit. Anna joins in by accessing an on-line 3D model of the room. A third friend, Dub, is then invited; he joins them by accessing the Web site for the room. The scenario introduces three different visitors who are remote from each other, and who have access to different technologies. Such scenarios have proved an effective way for a diverse team of researchers to communicate with each other, allowing us to shift our focus between studies, design, implementation and evaluation while maintaining a common context.

Figure 5. Bristol University's CyberJacket is worn by the 'physical' visitor in the Mack Room (on the right of the picture), and has location and orientation sensors for a handheld computer.

Vee, or the visitor in the role of Vee, has a handheld computer, an HP Jornada, which supports wireless network communications. She also has a jacket—Bristol University's *CyberJacket*, shown in Figure 5—that has within or on it several devices: an ultrasound detector to register position within the room (Randell & Muller, 2001), an electronic compass to show orientation, and a battery. Cables within the jacket connect these parts to each other and to the handheld. The recorded position is updated every few seconds and sent off to another 'server' computer (hidden behind the reception desk of the Mack Room). The handheld computer can be used to browse pages about the Mack Room's displays and artefacts based on the exhibition's catalogue and delivered from the Web server on the local network. A number of those pages generally describe thematic zones within the room. We support automatic triggering of those pages: if Vee walks into a thematic zone within the room, a Web page for that zone is automatically displayed.

Dub has a normal Web browser running on a laptop computer. We currently set this laptop in The Lighthouse but away from the Mack Room, and connect it to the local network. He can browse pages about the Mack Room, and by tracking the zone associated with each page displayed, we imply a 'position' in the room for him.

Anna uses a VR model of the Mack Room as well as a Web browser. Unlike the Web visitor, Anna's position is her position within the virtual environment. We initially experimented with the room-sized immersive VR display (ReaCTOR) at University College London (UCL), but current experimentation happens within The Lighthouse, where we use another networked laptop showing simpler 'desktop VR' graphics.

Each visitor has a microphone and headphones, and can talk with the other two. We initially used mobile telephones to support conversation, but now have audio connections within our system. Each visitor can see personal location as well as locations of the others. Vee and Dub each

have a map showing the Mack Room set within their Web page and showing visitors' ongoing positions as dots, as in Figure 6. Anna has her co–visitors shown as avatars, as in Figure 7.

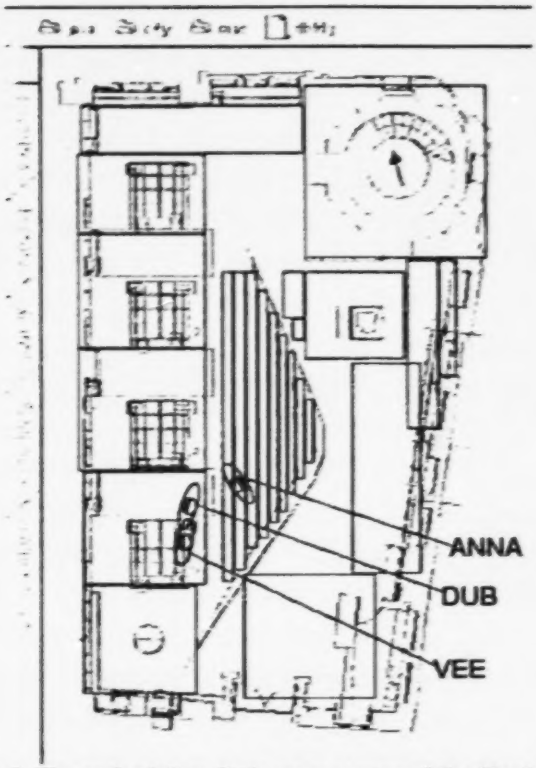

Figure 6. The web visitor, Dub, sees a map of the Mack Room showing the positions of himself and his co–visitors, and the outlines of thematic zones.

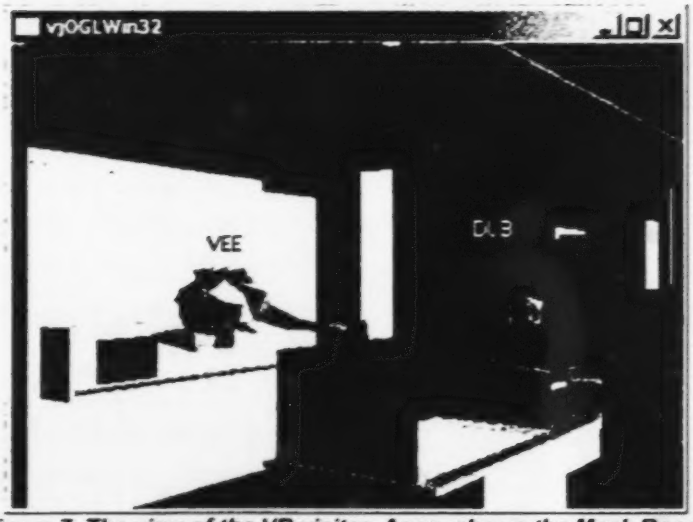

Figure 7. The view of the VR visitor, Anna, shows the Mack Room and avatars of her co–visitors.

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A server computer assists the visitors' personal systems. This runs a Web server based on the *Linky* software (www.equator.ecs.soton.ac.uk/technology/leaky/leaky.shtml) developed by the University of Southampton to deliver hypermedia tailored to the context of the visitor. At the moment, the 'context' used by this software is the visitor's location and the size of the display. Linky models associations between artefacts, zones and hypermedia content and, when delivering a Web page for such a location, it can use these associations to add descriptions of other things to see and places to move to. The server computer also runs software, called *EQUIP* (www.equator.ac.uk/technology/equip/index.htm), that collects the positions of the various visitors, relates them to zones, and triggers any automatic display of Web pages, maps and avatars. EQUIP also handles audio streams between visitors.

Experimenting with the System

Our approach to system development is to carry out short tests or trials, where minor system refinements can be made, in between each major developmental step. The first of these was carried out in two rooms in UCL when we had established an initial but rough communication between the wearable system and the VR system, i.e. between Vee and Anna. We have just begun a second trial in the Lighthouse, with the system supporting three–way communication between Vee, Anna and Dub.

In the UCL trial, we invited colleagues external to the City project to take on the roles of Vee and Anna, so that we might gain initial observations of interaction between a visitor in a virtual environment and a visitor with a handheld device in a physical environment. We videotaped the room where Vee was, and the VR as seen by Anna. We used a smaller version of the Mack Room and a number of objects related to Mackintosh, such as posters and postcards. This trial took place in UCL, rather than the Lighthouse, to let us experiment with an immersive VR display and to use UCL's infrastructure for recording activity in a virtual environment. One of the participants also wrote a lengthy feedback document after the event (Stenton, 2001).

In general, the participants felt that being in different geographical spaces did not make mutual awareness problematic. They extensively used the audio connection during the trial, especially when there were issues of shared reference to resolve. With limited facilities for sharing body orientation, they often spoke to each other to confirm or question exactly what they were facing and what they were referring to. Participants' engagement in the shared experience was shown by their use of vocabulary and body movements used in their everyday physical interactions, and by their awareness of each other's relative positions. Two instances of the latter involved the participant Phil (as Vee) who felt that he was in the way of Bill (Anna), and stepped back to free the view:

> P: Can you read this poster on the wall?
>
> B: Where? Which one are you looking at? That one...
>
> P: Oh, I'm sorry, I'm in the way mate. Can you read it now? Can you read the Willow Tearooms?

[...]

B: ...interferes with the wall. I believe I am too close to the physical wall.

P: Oh yeah – I'll go out of the way. There you go. Don't go through the wall.

B: That's the Willow Tearooms again.

P: Ah, the Willow Tearooms... Sorry, you must be standing on my foot then

B: I believe I'm sitting inside you. Yes. Its' rather...

P: Oh... inside me – what a thought!

The video footage revealed that in the first of these cases, Phil was not quite in Bill's way. However, Phil's concern and motion to avoid blocking Bill's view indicated a sense of shared experience and presence, As Phil later wrote:

> Clearly our dialogue was one of discovering the shared experience rather than sharing the visit. A defining moment for me was the request from my virtual partner, "Get out of the way; I can't see the poster." At this point it felt like we were in the same room rather than sharing information about two identical rooms in different places (Stenton).

With regard to the participants' use of the handheld and the VR equipment respectively, we observed a separate set of issues. One of the common visitor gestures in a traditional museum setting is to point at something. In the case of the VR, this is tracked and displayed;i.e. the avatar has a head and a hand. We observed, however, that when using the wearable and handheld, the visitor used his free hand to point at things. This gesture went unnoticed by the system and consequently by his companion. On the other hand, the digital visitor had great difficulty reading textual information due to limited resolution in the virtual environment. Barbieri and Paolini (2000) examined the same problem with regard to desktop VR in the Virtual Leonardo project, and they used 2D graphics in the delivery of textual information. We use the same solution in the desktop VR version of our system, although we are also considering the use of a second handheld device to display textual information to the VR visitor, Anna.

Field trials inside The Lighthouse are, at the time of writing, still in progress. The next section outlines this and other ongoing work.

Ongoing and Future work

So far we have discussed two parallel strands of our work. The studies and system development have raised our awareness of social context issues, and of the possibilities and the limits of our technology. While the studies continue, the system work has subdivided into two strands. First, our technological infrastructure is being refined and expanded to support future systems where we support visitors moving between buildings and

exhibitions across the city, and where visitors can create associations within a museum collection, between collections, and between collections and the city. Those associations will form a resource for their later visits, but also for the visits of others.

Secondly, our current prototype system is being tailored and adapted to suit the Mack Room and to take account of the results of our studies and exploratory evaluations. Project members are now using the initial prototype along with other departmental colleagues, Lighthouse staff and a few members of the public. We consider it particularly important to have the sociologist and museum studies experts in our project use the system themselves. However, we are not yet undertaking formal or sustained evaluation or observation. Instead, we make minor changes to the system from day to day in the light of these informal short-term trials. This has led to work on reducing the delay between a 'wearable' visitor moving into a thematic zone and the automatic Web page display, refining the position tracking, and changing the design of the pages shown on the handheld so as to better combine map and content.

In the course of these early and small design iterations, we improve our understanding of the Room, its visitors and our technology. While we have studied the Mack Room and its visitors before, and our system before, the combination is new. We have many ideas that may be implemented in the near future, such as more explicit support for the visitors acting as guides, graphical representation of visitors' paths through the room, and recommendation of people, places and artifacts. Still,we wish to leave space for new ideas and priorities to grow from our ongoing evaluation and observation. In pausing before a major redesign, we wish to secure a balance between the studies of visitors, studies of visitors using our system, technological interests in city–wide use and adaptive information, and theoretical work on notions of social context, interpretation and media.

Conclusion

Social context is an essential factor of the museum experience. Social interaction with companion(s) and other members of the public directly influences a museum experience. In the light of new technologies that support remote access to museum settings, we can see that the social context of the museum visit can extend beyond a physical room or building, and include computer-mediated interactions. Similarly, museums can enrich the digital site by better integrating it with the physical site. The *City* project aims at both understanding and supporting social interaction in cultural institutions; interaction that may be synchronous or asynchronous, and that may involve multiple media such as mobile computers, hypermedia and virtual environments. Our system supports interaction between physical and digital visitors, as well as between visitors and their environments, in a dynamic and contextual way. Our aim is a canvas of interaction that spans different places, people and times, with a focus on the creation and delivery of cultural information that is contextually appropriate, useful and engaging.

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References

Aoki, P. M. & A. Woodruff, (2000). Improving Electronic Guidebook Interfaces Using a Task-Oriented Design Approach. In *Designing Interactive Systems 2000*. ACM. 319-325.

Barbieri, T. & P. Paolini, (2000). Cooperative Visits for Museum WWW Sites a Year Later: Evaluating the Effect. In D. Bearman & J. Trant (Eds.) *Museums and the Web 2000*. Archives & Museum Informatics.

Chalmers, M. (2001). *Tales in the City: Adaptive Information in the Physical City*. Consulted February 11, 2002. (http://www.dcs.gla.ac.uk/equator/2001/01/vee.html).

Communications Design Team (1976). Spatial considerations. In Communications Design Team (Eds.) *Communicating with the Museum Visitors*. Royal Ontario Museum.

Diamond, J. (1986). The behaviour of Family Groups in Science Museums. *Curator*, 29(2). 139-154.

Falk, H. J. & L. D. Dierking, (1992). *The museum experience*. Washinghton: Whalesback Books.

Galani, A. (2001). *Vee in the Mackintosh Room*. Consulted February 11, 2002. (http://www.dcs.gla.ac.uk/equator/2001/05/scenario.html).

Lord, M. (1999). Editorial. *Museum International*, October 1999, Vol. 51 No 4. 3-3.

MacDonald, S. (1993). The enigma of the visitor sphinx. In S. Bicknell & G. Farmelo (Eds.) *Museum Visitor Studies in the 90s*. London: Science Museum, 77-85.

McManus, P.M. (1987). It's the Company you Keep... The Social Determination of Learning-related Behaviour in a Science Museum. *International Journal of Museum Management and Curatorship*, 6. 263-270.

Oppermann, R. & M. Specht, (1999). A Nomadic Information System for Adaptive Exhibition Guidance. In D. Bearman & J. Trant (Eds.) *Cultural Heritage Informatics: selected papers from ichim99*. Archives and Museum Informatics. 103-109.

Psarra, S. & T. Grajewski & M. O'Neil, (2002). Rethinking museum design – the effect of layout on visitors patterns of movement and use. *Museum Practice*, March 2002.

Randell, C. & H. Muller, (2001). Low Cost Indoor Positioning System. In G.D. Abowd, B. Brumitt & S. Shafer (Eds.) *Ubicomp 2001: Ubiquitous Computing*. Springer. 42-48.

Stenton, P. (2001). A user's view of the Equator Mackintosh Room Demo. Consulted February 11, 2002. (http://www.dcs.gla.ac.uk/equator/2001/06/stenton/stenton.html).

Vom Lehn, D., C. Heath & J. Hindmarsh, (2001). Exhibiting Interaction: Conduct of Collaboration in Museums and Galleries. *Symbolic Interaction*, Vol. 24 No 2. 189-216.

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